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Abstract: To help prevent extinction of the cheetah the Zoological Society of San Diego has undertaken a cheetah breeding program. Past and present breeding problems and events in Zoos are described. Fertility problems can be the most important issues in captive cheetah breeding. The Zoological society's successful cheetah breeding program and cooperative programs involving other zoos provide hope that the world's fastest land mammal has a future despite its diminishing habitat and declining populations in Africa and Asia.

# CHEETAHS

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**W**hen the cheetah lived in India, it lived most commonly in low rugged hills, and came down from its lair amidst rocks and boulders to hunt in the neighbouring plains. It hunted gazelle and antelope, and probably smaller animals and birds."

This quote from S.H. Prater's *Book of Indian Animals* paints a melancholy picture. It tells of the Indian cheetah that lives no longer in those rugged hills, for it is extinct. The last wild Indian cheetah was shot in 1948, and the final captive specimen died in the Mysore Zoo in the 1960s.

Cheetahs once lived in North America and Europe, and in Asia and Africa. The American and European forms are known only as fossils, Asian cheetahs may already be extinct and, to quote cheetah researcher Randall Eaton, the African cheetah is "racing to extinction."

It is estimated that between 10,000 and 24,000 cheetahs live in Africa. Their numbers are declining, partly because of hunting and poaching, but mainly because of human encroachment on their habitat. Human population growth rates as high as four percent per year through much of the cheetah's range in Africa leave little hope for this animal's long-term survival.

Within a few decades African cheetahs may vanish from the wild.

To help prevent extinction of this spectacular cat, the Zoological Society of San Diego has undertaken a cheetah breeding program. This program, which includes research on behavior and reproductive physiology, has resulted in 48 cheetah births at the Wild Animal Park since 1970. Such breeding in zoos can ensure the survival of cheetahs, even if they become extinct in the wild. Because of Federal import restrictions, it is nearly impossible to bring more cheetahs into the United States, even from places in Africa where they are hunted as vermin. Consequently, captive breeding programs must rely on individuals already at hand. It is imperative that these programs become more effective if cheetahs are to be preserved.

To many people, the word cheetah evokes visions of a lanky, spotted cat streaking across the plains at incredible speeds. The cheetah, well known as the world's fastest land mammal, has been clocked at speeds up to 70 miles per hour. A running cheetah covers at least 20 feet per stride, which is about the same as the stride of a race horse. But a galloping race horse completes only about two and one-quarter strides per second, whereas a fast-running

cheetah completes three and one-half strides per second. Consequently, the cheetah is much faster than a race horse, though it cannot run as far.

The cheetah's long, slender legs, greyhoundlike torso, and doglike claws are specializations which contribute to its speed. Cheetahs catch prey by running it down at high speed in broad daylight. With rare exceptions, cheetahs do not hunt at night. Running 60 or 70 miles per hour in the dark would be dangerous and foolhardy, and Nature did not design the cheetah foolishly.

One of the cheetah's hunting techniques is to move in full view toward a large herd of gazelles or other antelope until they scatter and run. If any animal in the herd shows a weakness, such as a limp, or if it moves more slowly than the rest, the cheetah singles it out and the chase is on. If, on the other hand, all in the herd appear capable of escaping, the hunt is abandoned. When the prey consists of a single animal or small herd, a stalking technique is used. With stealth and the use of available ground cover, the cheetah cautiously approaches until it is close enough to overtake its victim with one burst of speed. Whatever technique is used, the cheetah always focuses on a single individual, ignoring all others.

The cheetah brings down a gazelle or other antelope either by hooking it with the strongly curved dew claw, or by tripping it. Prey is usually gripped by the throat and suffocated, though smaller animals may be killed by a bite at the nape of the neck. After making a kill, the cheetah is often so overheated and exhausted that it must rest for 30 minutes before eating. When the cheetah finally feeds, it does so rapidly, looking about frequently. If a lion, hyena, or leopard comes along, it will

drive the cheetah off and consume the prey. Leopards and lions have also been known to kill and eat cheetahs.

Biologist George Schaller, observing cheetahs on the Serengeti Plain of Tanzania, found that they capture 50 percent of the animals they begin stalking or chasing. This is phenomenal compared to success rates of only 8 to 17 percent for lions in the same area.

Ironically, the cheetah's spectacular hunting prowess so fascinated man that these animals were captured for use in sport hunting, contributing to the species' demise in India, Persia, and Arabia. In describing the sport, S.H. Prater said,

For centuries the Cheetah, tamed and trained, has been kept by man and used in hunting. In India, the Cheetah is taken blindfolded to the scene of the hunt. It is unhooded and released in the proximity of a herd of antelope. A short crouching stalk, a few bounds of great length and rapidity, and the hunt is over. Either the quarry escapes, or the Cheetah fells it by means of the powerful dew-claw hooked into a hind-quarter or by knocking its feet from under it, and grips it in a stranglehold by the throat; the victim's throat is cut and the captor rewarded with a drink of warm blood collected in its accustomed feeding bowl.

A principal means of capturing cheetahs for such hunting was to run them down on horseback. Although a cheetah can run much faster than a horse, it can only keep its pace for 300 to 400 yards before it tires. Horses and gazelles have much greater endurance. If a cheetah is hunting it gives up the chase after 300 to 400 yards, and if chased by men on horseback, it can be captured after a race of that distance.

Man's fascination with the cheetah's hunting ability is at least 3,000 years old. Using cheetahs for sport hunting originated in Egypt, but by

the fifth century the practice had also gained popularity in India, Arabia, and Persia. Akbar the Great, one of India's Mogul emperors, is said to have kept 1,000 cheetahs for hunting. Asian cheetah populations were decimated by the 19th century, and despite man's long association with these magnificent animals, attempts at captive breeding were unsuccessful. To perpetuate the sport in Asia, cheetahs eventually had to be imported from East Africa.

According to Marvin Jones, registrar for the Zoological Society of San Diego, the first cheetah exhibited in Europe was housed at the London Zoo in 1829. The United States began exhibiting cheetahs in 1871 in New York's Central Park Zoo. Subsequently many cheetahs were exhibited in European and American zoos. Between 1930 and 1960, the London

Zoo obtained 42 cheetahs, but their average longevity was only three years. In North America, the cheetah was not a major zoo attraction until after 1945. Most of the early captive specimens were of East African origin, but because of a major decline in the wild population by the 1960s, the emphasis shifted to importation of cheetahs from southwest Africa. Nearly all the captive cheetahs alive today originated from southwest Africa.

The San Diego Zoo received its first cheetah in 1933 from the famous explorers Martin and Osa Johnson. During the next 37 years, 17 cheetahs were exhibited at the Zoo.

Records indicate that the first cheetahs to be born in captivity were born at the Philadelphia Zoo in 1956, but they did not survive. In 1960, a litter was born at the Krefeld Zoo in Germany, and the cubs were successfully hand-raised. In January and December of 1966, cheetahs were born in Luciano Spinelli's private collection

outside Rome. These were the first two recorded instances of captive-born cheetahs being successfully raised by the mother. In 1970, the Zoological Society of San Diego initiated a breeding program with five pairs of adult cheetahs imported from South-West Africa, now Namibia. Housed in a large, off-exhibit area at the San Diego Wild Animal Park, this colony produced its first litter on November 22, 1970. By 1976, 7 litters with a total of 31 cubs had been born. One female had eight cubs, setting a record for the largest litter size—a record that has not been broken. The majority of cheetahs born at the Wild Animal Park have been mother-raised.

During the next six years, only one litter was born at the Wild Animal Park and none of those cubs survived. The breeding animals in the collection had been captured as adults and may have passed reproductive age during this time. Most of the cubs from earlier litters had been sold or traded to other zoos, and most of those that remained proved infertile.

Animal Behaviorist Don Lindburg took charge of the cheetah breeding project in 1981. Each cheetah in our collection was evaluated for breeding potential, and trades and breeding loans were arranged with other zoos. Consequently, five litters, with a total of 14 cubs, have been born at the Wild Animal Park since 1982. All but 5 of the 12 surviving cubs have been sent to other zoos to fulfill breeding loan agreements. By sharing breeding adults and their offspring, zoos minimize the problems of inbreeding and of finding compatible mates for potential breeding animals.

Female cheetahs do not have an obvious estrus, and there are conflicting theories with regard to requirements for captive breeding. Some have suggested that it is best

to maintain a ratio of several males to one female and to pair only unfamiliar individuals. Others stress the need for large enclosures, removed from other African carnivores and with limited human contact. Still another theory suggests that fertility occurs only during two or three months in the summer and winter. In our work with cheetahs at the Wild Animal Park, we have found that novel conditions, such as providing new mates or new enclosures, will often stimulate breeding interest. Results of our research on these and other elements influencing fertility have enhanced the success of our captive breeding program.

Today, the cheetah's survival may depend on the success of captive breeding projects. In some parts of Africa, wild cheetahs are still shot as vermin, and their skins are often sold to tourists. Recent studies of wild cheetahs in South Africa have made us aware of two other factors that may adversely affect their survival. Genetic variation in cheetahs is extremely low; this might reduce their resistance to disease and adverse environmental conditions. In addition, semen samples collected from wild males show a low sperm count and a high incidence of abnormal sperm. These factors can negatively influence fertility and the continuation of the species. Since 1970, only 10 to 15 percent of the wild-caught cheetahs have successfully reproduced in captivity. In addition, most of the litters that have been born have been produced by a small portion of the breeding population.

The Society's cheetah breeding facility is located near the veterinary hospital at the Wild Animal Park. The 15-acre area is divided into several enclosures. There are two large enclosures (a five-acre area and a three-acre area), and there are eight

*Pesach, a male cheetah born March 13, 1982, now plays an important role in the Park's Wildlife Workshop. The animals in the Wildlife Workshop make appearances at Zoo and Wild Animal Park programs and help their trainers educate the public about the behaviors, management, and status of exotic animals in*

smaller pens which facilitate separation of males from females when there is no interest in breeding. The adult females live together in the largest enclosure. A long alley separates them from the individual pens which hold the males. When a female begins to spend a lot of time near the males' pens, and a pair starts to vocalize through the fence, the gate is opened to a neutral pen where the two animals are introduced. Breeding often results soon after a pair is placed together. Although the breeding facility is not open to the public, there is a cheetah exhibit located on the Kilimanjaro Hiking Trail at the Park.

With the revival of our breeding program in 1981, we found only one adult of proven fertility in the collection, a male born at the Wild Animal Park in 1976. Acquisition of two females on breeding loan paid early dividends with the birth of three litters in 1982. Through births and recent loans from other North American breeders, our cheetah collection now includes 14 individuals, including several youngsters that represent our main hopes for the future.

In November 1983, we acquired a breeding male from a private owner in Arizona through a loan arrangement. Our own breeding male had succumbed to an illness in August 1982, and our other available males had failed to breed in the past. Shortly after the new male arrived, our females had renewed interest in breeding. The first conception occurred in February 1984, followed by a second in April 1984. The cheetah's gestation period is approximately 90 days, and on May 10, 1984, a female named Cleo gave birth to three healthy cubs. About six weeks later, a litter of two cubs was born to another female named Nyrie. Our research on maternal behavior

and cub development is providing valuable information which will be useful in raising future litters.

Of the 48 cheetahs born at the Wild Animal Park, 12 survived less than one year. This is, however, a lower mortality rate than is found in wild populations, where the young are exposed to additional risks, including predation by other carnivores. Since 1982, we have further reduced cub mortality in our collection to 14 percent.

Fertility problems can be the most important issues in captive cheetah breeding. Upon introduction of a new male in 1984, one of our two adult females came into estrus within three weeks. However, our second female, Nyrie, remained unresponsive. It was at this point that a small, hormone-filled pump designed to bring females into estrus was inserted under the skin at Nyrie's shoulder. (See ZOOBOOK, April 1985.) Nyrie came into estrus within a few weeks, bred, and in about 90 days produced a litter of two cubs. This project, a cooperative effort between research, veterinary, and keeper staffs, has the potential to help increase the reproduction of cheetahs

and other species.

More recently, behavioral conditioning has allowed Pesach, a three-year-old male cheetah that is part of the Wild Animal Park's "Wildlife Workshop," to become a valuable semen donor without requiring anesthetization and electroejaculation—a usual technique. Samples are collected on a regular basis, and are being evaluated and frozen for possible future use by Reproductive Physiologist Barbara Durrant.

In addition to reproduction, we are also working on ways to achieve a more natural diet for captive cheetahs. Cheetahs, like many captive carnivores, are routinely fed a combination of ground meats. Eating this soft meatloaflike food does not require the tooth and muscle action necessary with the cheetah's natural diet in the wild. This unnatural diet may contribute to an oral defect (focal palatine erosion) that can spread infection throughout the body. We are experimenting with alternative foods, seeking some that will alleviate this problem.

All of this research is being done to help preserve one of the world's most beautiful and interesting cats. The

most recent mating at the Wild Animal Park occurred in March 1985; another breeding is hoped for this month. Any cubs born this year will be third-generation descendants of the animals imported in 1970. The Zoological Society's successful cheetah breeding program and cooperative programs involving other zoos provide hope that the world's fastest land mammal has a future despite its diminishing habitat and declining populations in Africa and Asia. **Z**